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IS 8118 (2008): Automotive Vehicles - Opacity (Smoke) of Exhaust Gas from Vehicles Equipped with Compression Ignition Engines Operating Under Free Acceleration - Method of Measurement [TED 2: Automotive Primemovers]

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भारतीय मानक

स्वचल वाहन — मुक्त त्वरण पद्धति के अंतर्गत प्रचालित संपीडन दहन इंजिनों से युक्त वाहनों से निष्कासित गैस की अपार्यता (धुआँ) —मापन पद्धति

(*तीसरा पुनरीक्षण*)

Indian Standard

AUTOMOTIVE VEHICLES — OPACITY (SMOKE) OF EXHUAST GAS FROM VEHICLES EQUIPPED WITH COMPRESSION IGNITION ENGINES OPERATING UNDER FREE ACCELERATION — METHOD OF MEASUREMENT

(Third Revision)

ICS 43.060;13.040.050

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NEW DELHI 110002

July 2008 Price Group 2

Automotive Primemovers Transmission, Steering Systems and Internal Combustion Engines
Sectional Committee, TED 2

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Primemovers Transmission, Steering Systems and Internal Combustion Engines Sectional Committee had been approved by the Transport Engineering Division Council.

The increasing emphasis on environment had necessitated the Government to bring out legislation under *Central Motor Vehicle Rules*, 1989 stating that the vehicles fitted with compression ignition (diesel) engines shall comply with the limits specified for opacity of exhaust gas for vehicles. A standardized procedure for checking the opacity during free acceleration was felt necessary by the committee and accordingly the present revision had been undertaken. The revision would be helpful in the assessment of the opacity of exhaust gas for vehicles fitted with compression ignition engines under free acceleration conditions needed for regulatory, testing and type approval agencies.

This standard was first published in 1976 and was revised in 1987 and 1998. The third revision of this standard was taken up to align with the latest development in the field. In the revised version 'Measurement procedure for opacity measurement' is given in detail.

The composition of the Committee responsible for formulation of this standard is given at Annex A.

While formulating this standard, considerable assistance has been derived from the following:

ECR 24.03 Uniform provisions concerning the approval of motor vehicles equipped with compression ignition engines with regard to the emission of visible pollutants by the engine

Doc: MoRTH/CMVR/TAP-115/116 Issue No. 2 Part 2 — Standards and test procedures for measurement of smoke levels by free acceleration for in-service vehicles fitted with diesel engines

Users of standards may also refer to *Central Motor Vehicle Rules*, 1989 as amended from time-to-time and as enforced by Statutory Authority under the Rules.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

AUTOMOTIVE VEHICLES — OPACITY (SMOKE) OF EXHUAST GAS FROM VEHICLES EQUIPPED WITH COMPRESSION IGNITION ENGINES OPERATING UNDER FREE ACCELERATION — METHOD OF MEASUREMENT

(*Third Revision*)

1 SCOPE

This standard specifies the method of measurement of opacity levels of the exhaust gas for vehicles fitted with compression ignition engines under free acceleration conditions.

2 REFERENCE

The following standard contains provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated was valid. All standard are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

IS No.	*Title*
14553 : 2008	Automotive vehicles — Apparatus for the measurement of opacity (smoke) of exhaust gas from vehicles equipped with compression ignition engines — Specification (*first revision*)

3 TEST PROCEDURE

3.1 The vehicle when subjected to the following test shall meet the limits of opacity stipulated by Government for that type of the vehicle.

3.2 Description of Test

3.2.1 *Requirements of Instrumentation*

3.2.1.1 The opacity meter used for the measurement of smoke shall meet the requirements specified in IS 14553.

3.2.1.2 The instrument shall be prepared, used and maintained as recommended in the instrument manufacturer's operation manual and it shall also be serviced and calibrated at such intervals as to ensure accuracy.

3.3 Installation of Opacity Meter for Tests Under Free Acceleration

3.3.1 *Sampling Opacity Meter*

3.3.1.1 The ratio of cross-sectional area of the probe to that of the exhaust pipe shall not be less than 0.05. The back pressure measured in the exhaust pipe at the opening of the probe shall not exceed 75 mm of water column.

3.3.1.2 The probe shall be tube with an open end facing forward in the axis of exhaust pipe or of the extension pipe, if such one is required. It shall be situated in a section where the distribution of smoke is approximately uniform. In order to achieve this, the probe shall be placed as far downstream in the exhaust pipe as possible or if necessary, in an extension pipe so that, if D is the diameter of exhaust pipe at the opening, the end of the probe is situated in a straight portion of at least 6 D in length upstream of the sampling point and 3 D in length downstream. If an extension pipe is used, no air shall be allowed to enter the joint.

3.3.1.3 The sampling system shall be such that at all engine speeds, the pressure of the sample at the opacimeter is within the limits specified. This may be verified by noting down the sample pressure at engine idling and maximum no load speeds. Depending on the characteristics of the opacimeter, control of sample pressure can be achieved by a fixed restriction or butterfly valve in the exhaust pipe or extension pipe. Irrespective of the method employed, the back pressure measured in the exhaust pipe at the opening of the probe shall not exceed 75 mm of water column.

3.3.1.4 The pipes connecting the opacity meter shall also be as short as possible. The pipe shall be inclined upwards from the sampling point to the opacimeter and sharp bends where soot is likely to accumulate shall be avoided. A by-pass valve may be provided upstream of opacimeter to isolate it from the exhaust gas flow when no measurement is being made.

3.3.2 *Full Flow Opacity Meters*

3.3.2.1 The joints in the connecting pipes, if any, between the exhaust pipe and the opacimeter shall not permit entry of outside air.

3.3.2.2 The pipes connecting the opacity meter shall be as short as possible, as prescribed in the case of sampling opacity meters. The pipe system shall be inclined upwards from the exhaust pipe to the opacimeter, and sharp bends where soot is likely to accumulate shall be avoided. A by-pass valve may be provided upstream of the opacity meter to isolate it from the exhaust gas flow when no measurement is being carried out.

3.3.2.3 A cooling system may also be provided upstream of the opacity meter.

3.4 Preparation of the Vehicle

3.4.1 The exhaust system shall not have any orifice through which the gases emitted by the engine may get diluted.

3.4.2 In case an engine has several exhaust outlets, they shall be connected to a single outlet in which the opacity measurement shall be made. If it is not possible to combine all such exhaust outlets into one, the smoke shall be measured in each outlet and arithmetical mean of the values shall be recorded at each outlet. The test shall be taken as valid only, if the highest and lowest values measured do not differ by more than 0.15.

3.4.3 The engine shall be in the normal working condition recommended by the manufacturer. At the time of measurement it shall be ensured that the engine oil shall be at a temperature of 60°C, *Min.*

3.5 Measurement Procedure for Free Acceleration Test

3.5.1 The test shall be carried out on an engine installed on a test bench or on a vehicle.

3.5.2 The engine shall first be brought to normal operating conditions during a road run or dynamic run on the test bench. The test shall be carried out immediately after completion of the warming-up period.

3.5.3 The combustion chamber shall not be cooled or fouled by a prolonged period of idling preceding the test.

3.5.4 The engine oil temperature should be measured and test should be allowed to proceed only after the engine oil temperature reaches 60°C.

3.5.5 During each free acceleration, maximum no load speed reached shall be within a band width of ± 500 rpm of average value in respect of three wheeler vehicles and ±300 rpm of the average value for all other categories of vehicles. The average value of rpm is calculated from last four readings, out of six readings during the initial flushing cycles.

3.5.6 With the engine at idling, the accelerator control shall be operated quickly, but not violently, so as to obtain maximum delivery from the injection pump. This position shall be maintained until maximum engine speed is reached and the governor gets activated comes into action. As soon as this speed is attained the accelerator shall be released until the engine resumes its idling speed and the opacity meter reverts to the corresponding conditions.

3.5.7 The operation specified in 3.5.6 shall be repeated not less than six times in order to clear the exhaust system and to allow for any necessary adjustment of the apparatus. Subsequently, the maximum opacity values obtained in each successive acceleration shall be taken as the values obtained while, after each acceleration, the engine shall be kept at idling. The values obtained shall be considered as stabilized when four of such consecutive readings are situated within a band width of 0.25/m and do not form a decreasing sequence. The absorption coefficient so recorded shall be the arithmetical mean of these four valid readings.

3.5.8 The web cam photo of the vehicle number-plate should appear in the emission certificate.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Automotive Primemovers Transmission, Steering Systems and Internal Combustion Engines Sectional Committee, TED 2

Organization	*Representative(s)*
Automotive Research Association of India, Pune	Shri M. K. Choudhari (***Chairman***) Shri N. V. Marathe (*Alternate*)
Ashok Leyland Ltd, Hosur	Shri M. N. Gamal Kumar Shri S. K. Raju (*Alternate*)
Association of State Road Transport Undertakings, New Delhi	Shri Srimali
Automotive Components Manufacturers Association of India, New Delhi	Shri Rajiv Mandke Shri G. P. Banerji (*Alternate*)
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Central Institute of Road Transport, Pune	Shri A. S. Lakra
Clutch Auto Ltd, Faridabad	Shri S. G. Mani Shri S. C. Sharma (*Alternate*)
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Kirloskar Oil Engines Ltd, Pune	Shri C. G. Ranade
Mahindra & Mahindra Ltd, Nasik	Dr Mathew Abraham Shri S. Ramamurthy (*Alternate*)
Maruti Udyog Ltd, Gurgaon	Shri Shiva Kumar
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Ministry of Road Transport & Highways, New Delhi	Director (Technical)
Motor Industries Co Ltd, Bangalore	Shri L. M. Naik Shri K. Jayanna (*Alternate*)
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Rane Power Steering Ltd, Pudukkotai	Shri S. Radhakrishnan

Organization	*Representative(s)*
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Society of Indian Automobile Manufacturers, New Delhi	Shri K. K. Gandhi Shri Sumit Sharma (*Alternate*)
Sona Steering Systems Ltd, New Delhi	Shri T. K. Pal
Tata Motors Ltd, Pune	Shri V. Laxminarayanan Shri S. R. Gore (*Alternate*)
Tractor Manufacturers Association, New Delhi	Shri T. C. Gopalan Shri S. Balasubramanian (*Alternate*)
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Shri J. A. Siddiqui
Scientist 'E' (TED), BIS

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